

REMARKS

Reconsideration and allowance of this application are respectfully requested. Claims 10-18 and 25-33 are withdrawn from further consideration, and claims 34-92 are cancelled. Claims 1-9 and 19-24, as amended herein, are submitted for the Examiner's reconsideration.

Claims 3 and 22 have been amended solely to provide proper antecedence and to have the claims better conform to the requirements of U.S. practice. No new matter has been added by these amendments.

In the Office Action, the Examiner objected to claim 9 as being redundant to claim 7. Claim 9 has been amended to correct the informality.

Regarding the art rejections, claims 19-24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the article titled "Stress control in GaN grown on silicon (111) by metalorganic vapor phase epitaxy", pp. 3230-3232, to Feltin et al. ("Feltin"). Applicants submit, however, that the claims are patentably distinguishable over Feltin.

The Feltin article describes a structure in which an AlN layer is grown on a silicon substrate, and a GaN layer is formed on the AlN layer. Then, a first superlattice formed of thin layers of AlN and GaN is provided atop the GaN layer. Next, a GaN layer is formed over the first superlattice; and then a second superlattice is provided that is similarly formed of thin AlN and GaN layers. (See FIG. 1; and p. 3230, col. 1, 2<sup>nd</sup> ¶ - p. 3231, col. 1, 1<sup>st</sup> ¶). Feltin therefore describes superlattices that are formed of AlN and GaN layers. Feltin does not disclose or suggest that the superlattice is formed of layers of semiconductors having the formula  $Al_rGa_{(1-r)}N$ , where  $0 < r < 1$ .

Feltin neither discloses nor suggests:

a buffer structure including a first superlattice directly overlying said nucleation layer, said first superlattice including a plurality of nitride-based semiconductors of different compositions, each of said plurality of nitride-based semiconductors having its respective composition according to the formula  $\text{Al}_r\text{Ga}_{(1-r)}\text{N}$ , where  $0 < r < 1$

as called for in claim 19.

It follows that Feltin does not disclose or suggest the combination defined in claim 19, and claim 19 is therefore patentably distinct and unobvious over the reference.

Claims 20-24 depend from claim 19, and each further defines and limits the invention set out in the independent claim. It follows that each of claims 20-24 likewise defines a combination that is patentably distinguishable over the Feltin reference for at least the same reasons.

The Examiner also rejected claims 1-9 under 35 U.S.C. § 103(a) as being unpatentable over the article titled "Thick crack-free blue light-emitting diodes on Si(111) using low-temperature AlN interlayers and *in situ*  $\text{Si}_x\text{N}_y$  Masking", pp. 3670-3672 to Dadgar et al. ("Dadgar") in view of Feltin. It is submitted, however, that the claims are patentably distinguishable over the cited references.

The Dadgar article describes a GaN-based light-emitting diode structure in which several monolayers of aluminum are deposited on an n-type silicon substrate and then treated to form an AlN:Si seed layer. Then, a silicon doped GaN layer is formed atop the structure which is followed by a first LT-Aln:Si layer, a GaN:Si layer, and a second LT-Aln:Si layer. (See p. 3670, col. 1, 2<sup>nd</sup> ¶). As acknowledged by the Examiner, Dadgar does not disclose or suggest a superlattice, and therefore Dadgar does not remedy the deficiencies of Felton.

Thus, neither Dadgar nor Felton discloses or suggests:

a buffer structure including one or more superlattices overlying said nucleation layer, each

said superlattice including a plurality of nitride-based semiconductors of different compositions, each of said plurality of nitride-based semiconductors of at least one said superlattice having its respective composition according to the formula  $\text{Al}_r\text{Ga}_{(1-r)}\text{N}$ , where  $0 < r < 1$

as recited in claim 1.

Moreover, though Dadgar describes depositing a few monolayers of aluminum atop the silicon substrate, the aluminum is then caused to react with the silicon substrate to grow a 20 nm thick *AlN:Si* layer. A person of ordinary skill in the relevant art would understand that the few monolayers of aluminum are completely consumed by this reaction so that *no aluminum remains*. Dadgar does not disclose or suggest a structure having an *aluminum layer directly overlying* a surface of a silicon substrate.

Felton describes an AlN layer that is grown *directly atop the silicon substrate* and does not remedy the deficiency of Dadgar.

Neither Dadgar nor Felton discloses or suggests:

a layer of aluminum directly overlying a first surface of said substrate

as called for in claim 1.

As described above, Dadgar describes the formation of 20 nm thick *AlN:Si* layer that consumes the few monolayers of deposited aluminum so that the next layer, i.e., the silicon doped GaN layer, is deposited directly atop the *AlN:Si* layer. Dadgar does not disclose or suggest a nitride semiconductor directly overlying an *aluminum layer*.

Similarly, Felton teaches a GaN layer directly disposed atop an AlN layer and does not disclose or suggest a nitride semiconductor directly overlying an *aluminum layer*.

Neither Dadgar nor Felton discloses or suggests:

a polycrystalline nucleation layer of a nitride semiconductor directly overlying said aluminum layer

as recited in claim 1.

It follows that neither Dadgar nor Felton, whether taken alone or in combination, discloses or suggests the semiconductor structure set out in claim 1. Therefore, claim 1 is patentably distinct and unobvious over the cited references.

Claims 2-9 depend from claim 1, and each further defines and limits the invention set out in the independent claim. It follows that, at least for the same reasons, each of claims 2-9 likewise defines a combination that is patentably distinguishable over the cited art.

Accordingly, the withdrawal of the rejections under 35 U.S.C. § 103(a) is respectfully requested.

As it is believed that all of the rejections set forth in the Official Action have been fully met, favorable reconsideration and allowance are earnestly solicited. If, however, for any reason the Examiner does not believe that such action can be taken at this time, it is respectfully requested that the Examiner telephone applicant's attorney at (908) 654-5000 in order to overcome any additional objections which the Examiner might have.

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If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge Deposit Account No. 12-1095 therefor.

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Respectfully submitted,

By



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